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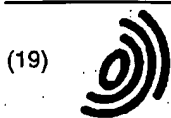
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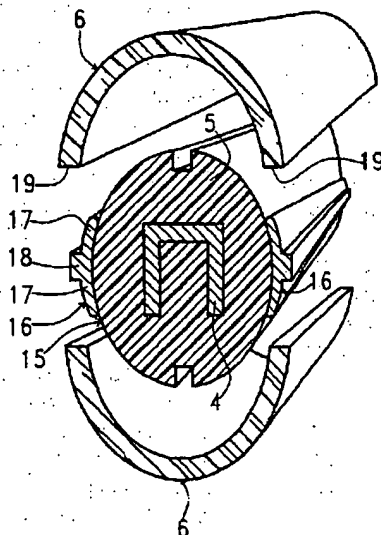
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(54) **Process for manufacturing motor car steering wheels with an external shell made of carbon fibres and steering wheel thus obtained**

(57) A process for manufacturing motor car steering wheels with an external shell made of carbon fibres, comprises preparation of piles (7) of sheet materials, hot moulding thereof for obtaining respective half-shells (6) with a shape corresponding to that of respective halves of the steering wheel being manufactured, mechanical

flattening of the front surfaces (19) of the two half-shells, mounting of the two half-shells (6) above and under a steering wheel body (15) formed by a metallic core (4) covered by resin (5). The steering wheel body (15) has previously been provided with lateral profiles (16) which then act as fixing supports for the two half-shells (6).

Fig.4



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## Description

[0001] The present invention relates to a process for manufacturing motor car steering wheels with an external shell made of carbon fibres and the steering wheel thus obtained.

[0002] The steering wheels for motor cars are presently made of an internal metallic core covered by resin and of an external coating and finishing shell, made of various materials, which represents the appearing part of the steering wheel.

[0003] Among the several known processes for manufacturing motor car steering wheels it is to be noticed the process providing for formation of two half-shells by hot pressing of one or more material sheet inside moulds of suitable shape, subsequent mechanical flattening working of the junction line of the two half-shells, application of the half-shells on a steering wheel body formed by a metallic core covered by resin and mutual fixing of the two half-shells along said junction line.

[0004] Fixing of the two half-shells represents a particularly delicate step of the manufacturing process, specially in case of half-shells of small thickness as those made of carbon fibres.

[0005] Object of the present invention is to provide a process of the above said type which is particularly suitable for manufacturing steering wheels with a shell of carbon fibres.

[0006] According to the invention this object is obtained by a process comprising preparation of piles of sheet materials, hot moulding thereof for obtaining respective half-shells with a shape corresponding to that of respective halves of the steering wheel being manufactured; mechanical flattening of the front surfaces of the two half-shells, mounting of the two half-shells above and under a steering wheel body formed by a metallic core covered by resin, characterized in that said steering wheel body is previously provided with lateral profiles adapted for acting as fixing supports for the two half-shells.

[0007] Fixing of the half-shells is preferably obtained by gluing of the internal surface of the half-shells on the external surface of the lateral profiles, suitably complementarily shaped.

[0008] It has been possible to verify that in this way a very strong structural assembling is obtained which is able to resist all the ageing and safety test required by the automobile manufacturers.

[0009] The features of the present invention will be made more evident by the following detailed description of an embodiment thereof which is illustrated by non-limiting way in the accompanying drawings, in which:

Figure 1 shows, partly in view and partly in section, a typical steering wheel for motor car;

Figure 2 schematically shows several steps of the manufacturing process according to the present invention;

Figure 3 shows a partial perspective representation of a half-shell after the hot moulding step and the subsequent flattening step and before the provision of the coupling teeth;

Figure 4 shows in perspective view, just before the final assembling of the two half-shells, a portion of a steering wheel manufactured by the process according to the invention;

Figure 5 shows the same steering wheel in cross-section, in assembled condition.

[0010] As shown in Figure 1, a typical steering wheel for motor car is composed by a central part or hub part 1, a plurality of radial spokes 2 and an external rim 3.

[0011] According to the present technology the external rim 3 and the spokes 2 consist of an internal metallic core 4 covered by resin 5 and an external coating and finishing shell, in its turn formed by two half-shells 6 superimposed to each other and joined together.

[0012] The two half-shells 6 are manufactured by using the technology schematically illustrated in Figure 2, steps a)-d).

[0013] More precisely, the forming step provides for hot moulding of a pile of sheet materials, globally designated with 7 in Figure 2, step a), inside a metal mould 8 with a cavity 9 of suitable shape, on which a cover 10 with a protrusion 10 of complementary shape with respect to the cavity 9 is superimposed.

[0014] The pile 7 may be composed by sheets of various thickness so as to provide a total thickness of the half-shell which is comprised between 1.0 and 2.0 mm.

[0015] The single sheets are made of carbon fibres combined with glass fibres or aramidic fibres or a combination of said fibres.

[0016] The above mentioned fibres are impregnated with specific resins which at the end of the cycle are able to grant structural rigidity to the half-shell assembly. The resins used for impregnating the fibres can be of various nature, for example epoxy, polyester, polyurethane. The impregnation of the fibres may be carried out both before the use, by means of specific machines which dip the fabric into the resin according a specific process, and during the half-shell moulding step, by smearing, injection or other dispensing systems which allow impregnation of the fibres inside the mould.

[0017] The moulding time depends on the temperature being used and is comprised between 1 and 3.5 minutes. The mould temperature, for an optimal process, is comprised between 70 °C and 150 °C. The moulding pressure requires for a correct catalysis of the resins is 0.7 bar.

[0018] The half-shell obtained at the end of the moulding operation is illustrated in Figure 2, step b), and comprises a curved central part 12 and two lateral fins 13. The latter are then removed by mechanical flattening working, step c) of Figure 2. The half-shell is then as shown in Figure 3.

[0019] Two half-shells obtained in this way are then

subjected to a painting, step d) of Figure 2, and provided with glue 14 on their internal surface, step e) of Figure 2. It is possible to use glues of several kind, which have structural functions, belonging to epoxy, polyurethane and methacrylate families.

[0020] Meanwhile, a steering wheel body 15 (formed by the metallic core 4 and the resin covering 5 as previously said with reference to Figure 1) has separately been prepared, to which two symmetrical profiles 16 are applied, for example by clamping, each of which is formed by two lateral flanges 17 with internal surface complementary to the external surface of the steering wheel body 15 and external surface complementary to the internal surface of the two half-shells and by an intermediate rib 18 adapted for operating as abutment shoulder for the front surfaces 19 of the two half-shells. The external surfaces of the flanges 17 are smeared with suitable glue, of course of the same type as the glue 14.

[0021] The two half-shells 6 are put one above and the other under the steering wheel body 15 with the profiles 16, step f) of Figure 2, and fixed by gluing thanks to the glue previously applied to the same half-shells and to the profiles 16.

[0022] The assembly obtained in this way, step g) of Figure 2, may leave a portion of the profiles 16 at sight or hidden them completely.

[0023] The painting operation may be carried out after the final assembling rather than on the single half-shells.

[0024] It is to be noted that the steering wheel body 18 is preferably provided with two diametrically opposite grooves 19 which serve for compensating the thermal expansions of the resin 5.

[0025] The assembly of the two half-shells 6 and the steering wheel body 15 with the profiles 16 is shown in perspective view, just before the final assembling, in Figure 4.

[0026] The same assembly is shown in cross-section, with assembling being ended, in Figure 5.

#### Claims

1. Process for manufacturing motor car steering wheels with an external shell made of carbon fibres, comprising preparation of piles (7) of sheet materials, hot moulding thereof for obtaining respective half-shells (6) with a shape corresponding to that of respective halves of the steering wheel being manufactured, mechanical flattening of the front surfaces (19) of the two half-shells, mounting of the two half-shells (6) above and under a steering wheel body (15) formed by a metallic core (4) covered by resin (5), characterized in that said steering wheel body (15) is previously provided with lateral profiles (16) adapted for acting as fixing supports for the two half-shells (6).

2. Process according to claim 1, characterized in that

fixing of the two half-shells (6) is obtained by gluing of the internal surface of the half-shells on the external surface of the lateral profiles (16), which is complementarily shaped.

3. Process according to claim 1, characterized in that each one of said profiles (16) is formed by two lateral flanges (17) arranged at a side of the steering wheel body (15) and by an intermediate rib (18) adapted for acting as abutment shoulder for the front surfaces (19) of the two half-shells (6).

4. Process according to claim 1, characterized in that said sheet materials consist of carbon fibres and glass fibres.

5. Process according to claim 1, characterized in that said sheet materials consist of carbon fibres and aramidic fibres.

6. Process according to claim 1, characterized in that said sheet materials consist of carbon fibres, glass fibres and aramidic fibres.

7. Process according to any claim 3, 4, 5 or 6, characterized in that said fibres are impregnated by resin.

8. Process according to claim 1, characterized in that said hot moulding is carried out at a temperature comprised between 70 °C and 150 °C.

9. Process according to claim 1, characterized in that said hot moulding is carried out for a time comprised between 1 and 3.5 minutes.

10. Process according to claim 1, characterized in that said hot moulding is carried out at a pressure comprised at least equal to 0.7 bar.

11. Steering wheel for motor cars, comprising a steering wheel body (15) formed by a metallic core (4) covered by resin (5) and a shell consisting of two half-shells (6) put above and under said steering wheel body (15) characterized in that said steering wheel body (15) is provided with lateral profiles (16) which act as fixing supports for the two half-shells (6).

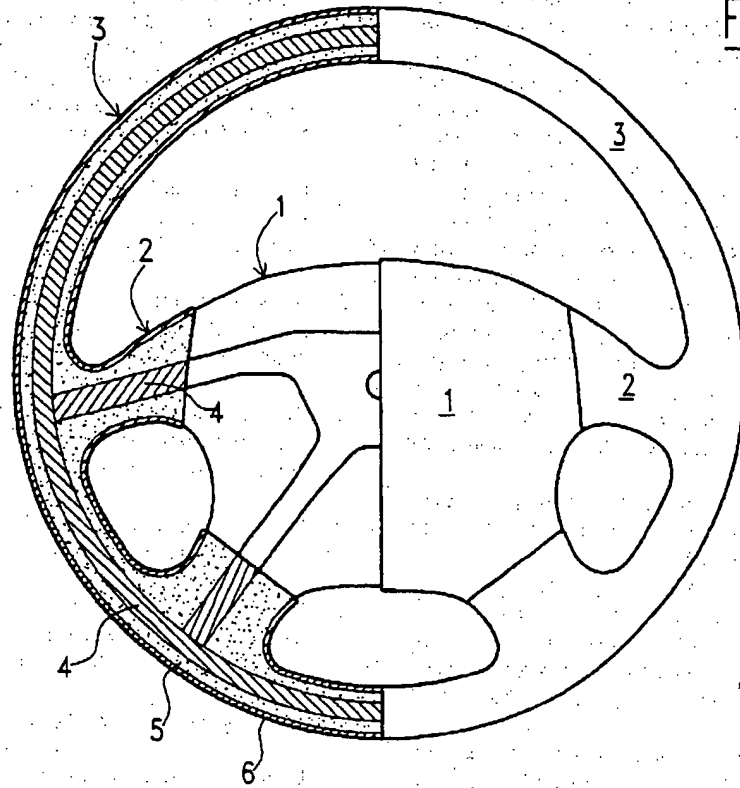


Fig. 1

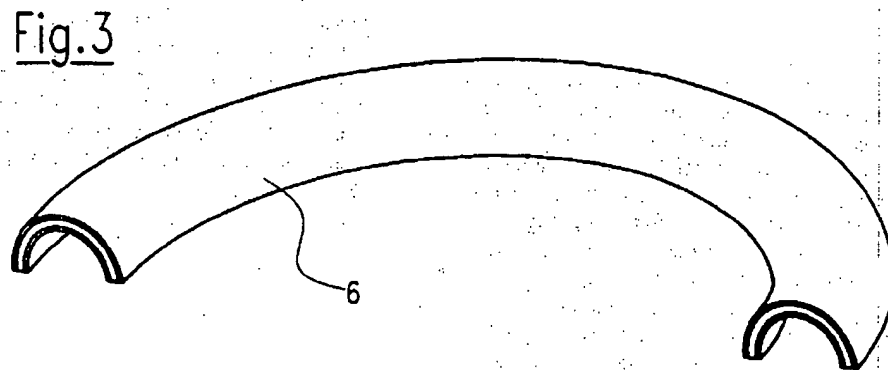


Fig. 3

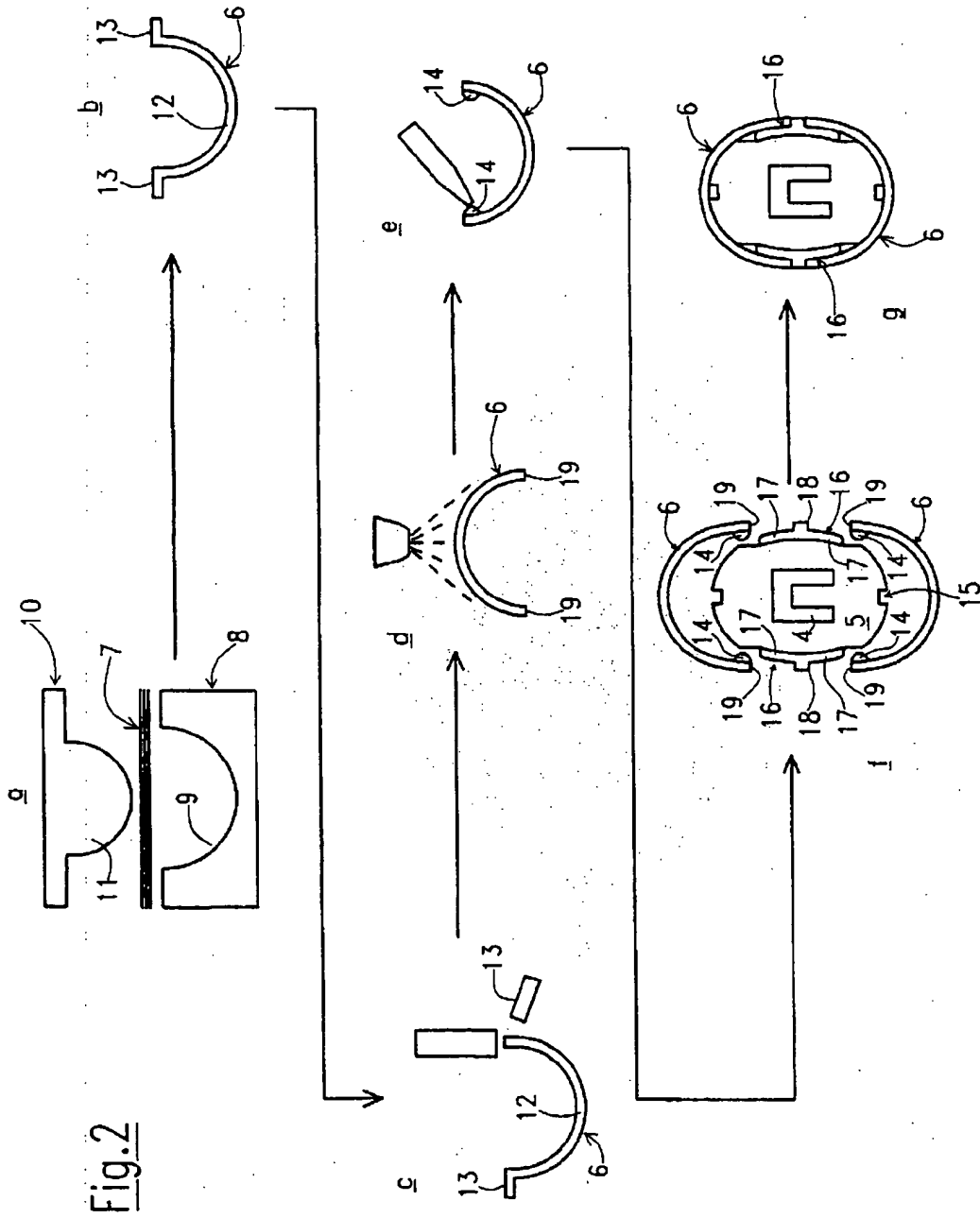


Fig.4

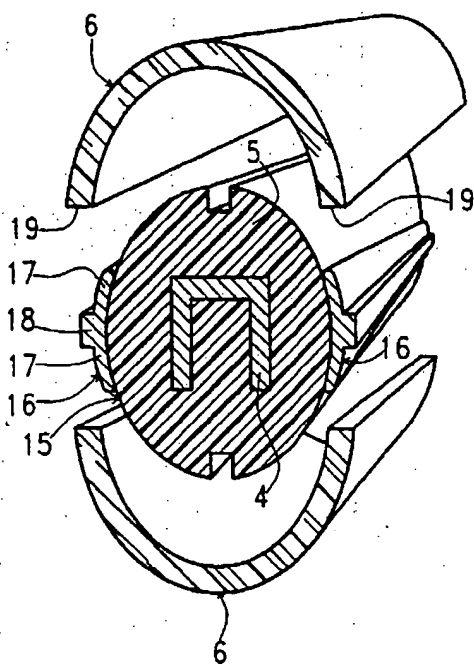
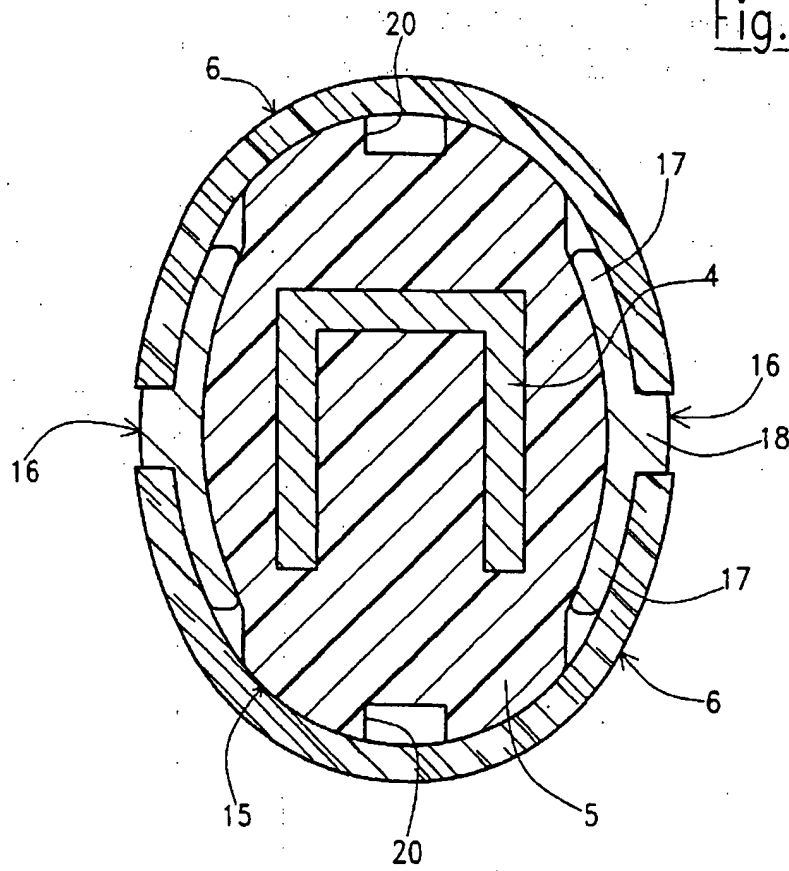


Fig.5







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# EUROPEAN SEARCH REPORT

Application Number  
EP 99 83 0090

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION
A	DE 298 13 895 U (PETRI AG) 1 October 1998 (1998-10-01) * page 6, line 5 - page 8, line 24; figures *	1, 11	B62D1/06 B29C65/50 B29C70/86
A	US 4 683 018 A (SUTCLIFFE DAVID T. ET AL) 28 July 1987 (1987-07-28) * column 1, line 58 - column 2, line 66; figures *	1	
			TECHNICAL FIELDS SEARCHED
			B62D B29C
The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>13 July 1999</b>	Examiner <b>Kulozik, E</b>
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